

## OSWER VAPOR INTRUSION ASSESSMENT

Groundwater Concentration to Indoor Air Concentration (GWC-IAC) Calculator Version 2.0, May 2012 RSLs

Parameter	Symbol	Value	Instructions
Exposure Scenario	Scenario	Commercial	Select residential or commercial scenario from pull down list
Target Risk for Carcinogens	TCR	1.00E-06	Enter target risk for carcinogens (for comparison to the calculated VI carcinogenic risk in column F)
Target Hazard Quotient for Non-Carcinogens	THQ	1	Enter target hazard quotient for non-carcinogens (for comparison to the calculated VI hazard in column G)
Average Groundwater Temperature (°C)	Tgw	25	Enter average of the stabilized groundwater temperature to correct Henry's Law Constant for groundwater target concentrations

CAS	Chemical Name	Site Groundwater Concentration	Calculated Indoor Air Concentration	VI Carcinogenic Risk	VI Hazard
		Cgw (ug/L)	Cia (ug/m <sup>3</sup> )	CR	HQ
83-32-9	Acenaphthene	--	--	--	--
75-07-0	Acetaldehyde	--	--	--	--
67-64-1	Acetone	--	--	--	--
75-86-5	Acetone Cyanohydrin	--	--	--	--
75-05-8	Acetonitrile	--	--	--	--
98-86-2	Acetophenone	--	--	--	--
107-02-8	Acrolein	--	--	--	--
107-13-1	Acrylonitrile	--	--	--	--
107-05-1	Allyl Chloride	--	--	--	--
120-12-7	Anthracene	--	--	--	--
11104-28-2	Aroclor 1221	--	--	--	--
11141-16-5	Aroclor 1232	--	--	--	--
103-33-3	Azobenzene	--	--	--	--
100-52-7	Benzaldehyde	--	--	--	--
x 71-43-2	Benzene	--	--	--	--
108-98-5	Benzenthiol	--	--	--	--
98-07-7	Benzotrifluoride	--	--	--	--
100-44-7	Benzyl Chloride	--	--	--	--
92-52-4	Biphenyl, 1,1'	--	--	--	--
108-60-1	Bis(2-chloro-1-methylethyl) ether	--	--	--	--
111-44-4	Bis(2-chloroethyl)ether	--	--	--	--
542-88-1	Bis(chloromethyl)ether	--	--	--	--
107-04-0	Bromo-2-chloroethane, 1-	--	--	--	--
108-86-1	Bromobenzene	--	--	--	--
74-97-5	Bromochloromethane	--	--	--	--
75-27-4	Bromodichloromethane	--	--	--	--
74-83-9	Bromomethane	--	--	--	--
106-99-0	Butadiene, 1,3-	--	--	--	--
x 104-51-8	Butylbenzene, n-	--	--	--	--
75-15-0	Carbon Disulfide	--	--	--	--
56-23-5	Carbon Tetrachloride	--	--	--	--
75-68-3	Chloro-1,1-difluoroethane, 1-	--	--	--	--
126-99-8	Chloro-1,3-butadiene, 2-	--	--	--	--
107-20-0	Chloroacetaldehyde, 2-	--	--	--	--
108-90-7	Chlorobenzene	--	--	--	--
98-56-6	Chlorobenzotrifluoride, 4-	--	--	--	--
109-69-3	Chlorobutane, 1-	--	--	--	--
75-45-6	Chlorodifluoromethane	--	--	--	--
67-66-3	Chloroform	--	--	--	--
x 74-87-3	Chlormethane	--	--	--	--
107-30-2	Chloromethyl Methyl Ether	--	--	--	--
91-58-7	Chloronaphthalene, Beta-	--	--	--	--
95-57-8	Chlorophenol, 2-	--	--	--	--
76-06-2	Chloropicrin	--	--	--	--
95-49-8	Chlorotoluene, o-	--	--	--	--
106-43-4	Chlorotoluene, p-	--	--	--	--
123-73-9	Crotonaldehyde, trans-	--	--	--	--
98-82-8	Cumene	--	--	--	--
57-12-5	Cyanide (CN-)	--	--	--	--
460-19-5	Cyanogen	--	--	--	--
506-68-3	Cyanogen Bromide	--	--	--	--
506-77-4	Cyanogen Chloride	--	--	--	--
110-82-7	Cyclohexane	--	--	--	--
132-64-9	Dibenzofuran	--	--	--	--

Inhalation Unit Risk	IUR Source*	Reference Concentration	RFC Source*	Mutagenic Indicator
		RfC (ug/m <sup>3</sup> ) (mg/m <sup>3</sup> )		
2.20E-06	I	9.00E-03 3.10E+01	I A	
		6.00E-02 6.00E-02	P I	
		2.00E-05	I	
6.80E-05	I	2.00E-03	I	
6.00E-06	CA	1.00E-03	I	
		5.70E-04 5.70E-04	S S	
		3.10E-05	I	
7.80E-06	I	3.00E-02	I	
		4.90E-05 4.00E-04	CA P	
1.00E-05 3.30E-04	H I	6.00E-02 4.00E-02	X X	
6.20E-02	I			
6.00E-04	X	6.00E-02 4.00E-02	I X	
		3.70E-05 5.00E-03	CA I	
3.00E-05	I	2.00E-03	I	
		7.00E-01	I	
6.00E-06	I	1.00E-01 5.00E+01	I I	
		3.00E-04	2.00E-02	I
		5.00E-02 3.00E-01	P P	
		5.00E+01 9.80E-02	I A	
2.30E-05	I	9.00E-02	I	
6.90E-04	CA			
		4.00E-04	CA	
		4.00E-01	I	
		6.00E+00	I	

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		Cgw (ug/L)	Cia (ug/m <sup>3</sup> )	CR	HQ
96-12-8	Dibromo-3-chloropropane, 1,2-	--	--	--	--
124-48-1	Dibromochloromethane	--	--	--	--
106-93-4	Dibromoethane, 1,2-	--	--	--	--
74-95-3	Dibromomethane (Methylene Bromide)	--	--	--	--
764-41-0	Dichloro-2-butene, 1,4-	--	--	--	--
1476-11-5	Dichloro-2-butene, cis-1,4-	--	--	--	--
110-57-6	Dichloro-2-butene, trans-1,4-	--	--	--	--
95-50-1	Dichlorobenzene, 1,2-	--	--	--	--
x 106-46-7	Dichlorobenzene, 1,4-	--	--	--	--
x 75-71-8	Dichlorodifluoromethane	--	--	--	--
x 75-34-3	Dichloroethane, 1,1-	--	--	--	--
107-06-2	Dichloroethane, 1,2-	--	--	--	--
x 75-35-4	Dichloroethylene, 1,1-	--	--	--	--
x 540-59-0	Dichloroethylene, 1,2- (Mixed Isomers)	--	--	--	--
156-59-2	Dichloroethylene, 1,2-cis-	--	--	--	--
156-60-5	Dichloroethylene, 1,2-trans-	--	--	--	--
78-87-5	Dichloropropene, 1,2-	--	--	--	--
142-28-9	Dichloropropene, 1,3-	--	--	--	--
542-75-6	Dichloropropene, 1,3-	--	--	--	--
77-73-6	Dicyclopentadiene	--	--	--	--
75-37-6	Diffluoroethane, 1,1-	--	--	--	--
94-58-6	Dihydrosafrone	--	--	--	--
108-20-3	Diisopropyl Ether	--	--	--	--
1445-75-6	Diisopropyl Methylphosphonate	--	--	--	--
121-69-7	Dimethylaniline, N,N-	--	--	--	--
120-61-6	Dimethylterephthalate	--	--	--	--
513-37-1	Dimethylvinylchloride	--	--	--	--
505-29-3	Dithiane, 1,4-	--	--	--	--
106-89-8	Epichlorohydrin	--	--	--	--
106-88-7	Epoxybutane, 1,2-	--	--	--	--
x 759-94-4	EPTC	--	--	--	--
141-78-6	Ethyl Acetate	--	--	--	--
x 140-88-5	Ethyl Acrylate	--	--	--	--
75-00-3	Ethyl Chloride	--	--	--	--
60-29-7	Ethyl Ether	--	--	--	--
97-63-2	Ethyl Methacrylate	--	--	--	--
100-41-4	Ethylbenzene	--	--	--	--
75-21-8	Ethylene Oxide	--	--	--	--
151-56-4	Ethyleneimine	--	--	--	--
86-73-7	Fluorene	--	--	--	--
110-00-9	Furan	--	--	--	--
822-06-0	Hexamethylene Diisocyanate, 1,6-	--	--	--	--
110-54-3	Hexane, N-	--	--	--	--
591-78-6	Hexanone, 2-	--	--	--	--
74-90-8	Hydrogen Cyanide	--	--	--	--
NA (JP-7)	JP-7	No HLC	--	--	--
7439-97-6	Mercury (elemental)	--	--	--	--
126-98-7	Methacrylonitrile	--	--	--	--
79-20-9	Methyl Acetate	--	--	--	--
96-33-3	Methyl Acrylate	--	--	--	--
78-93-3	Methyl Ethyl Ketone (2-Butanone)	--	--	--	--
108-10-1	Methyl Isobutyl Ketone (4-methyl-2-pentanone)	--	--	--	--
624-83-9	Methyl Isocyanate	--	--	--	--
80-62-6	Methyl Methacrylate	--	--	--	--

Inhalation Unit Risk	IUR Source*	Reference Concentration	RFC Source*	Mutagenic Indicator
		RfC (ug/m <sup>3</sup> ) (mg/m <sup>3</sup> )		
6.00E-03	P	2.00E-04	I	Mut
2.70E-05	CA			
6.00E-04	I	9.00E-03	I	
		4.00E-03	X	
4.20E-03	P			
4.20E-03	P			
4.20E-03	P			
		2.00E-01	H	
1.10E-05	CA	8.00E-01	I	
		1.00E-01	X	
1.60E-06	CA			
2.60E-05	I	7.00E-03	P	
		2.00E-01	I	
		6.00E-02	P	
1.00E-05	CA	4.00E-03	I	
4.00E-06	I	2.00E-02	I	
		7.00E-03	P	
		4.00E+01	I	
1.30E-05	CA			
		7.00E-01	P	
1.30E-05	CA			
1.20E-06	I	1.00E-03	I	
		2.00E-02	I	
		1.00E+01	I	
		3.00E-01	P	
2.50E-06	CA	1.00E+00	I	
8.80E-05	CA	3.00E-02	CA	
1.90E-02	CA			
		1.00E-05	I	
		7.00E-01	I	
		3.00E-02	I	
		8.00E-04	I	
		3.00E-01	A	
		3.00E-04	I	
		7.00E-04	H	
		5.00E+00	I	
		3.00E+00	I	
		1.00E-03	CA	
		7.00E-01	I	

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CAS	Chemical Name	Site Groundwater Concentration	Calculated Indoor Air Concentration	VI Carcinogenic Risk	VI Hazard
		Cgw (ug/L)	Cia (ug/m³)	CR	HQ
25013-15-4	Methyl Styrene (Mixed Isomers)	--	--	--	--
1634-04-4	Methyl tert-Butyl Ether (MTBE)	--	--	--	--
75-09-2	Methylene Chloride	--	--	--	--
90-12-0	Methylnaphthalene, 1-	--	--	--	--
91-57-6	Methylnaphthalene, 2-	--	--	--	--
98-83-9	Methylstyrene, Alpha-	--	--	--	--
8012-95-1	Mineral oils	--	--	--	--
64724-95-6	Naphtha, High Flash Aromatic (HFAN)		No HLC	--	--
91-20-3	Naphthalene	--	--	--	--
98-95-3	Nitrobenzene	--	--	--	--
75-52-5	Nitromethane	--	--	--	--
79-46-9	Nitropropane, 2-	--	--	--	--
924-16-3	Nitrosodi-N-butylamine, N-	--	--	--	--
88-72-2	Nitrotoluene, o-	--	--	--	--
111-84-2	Nonane, n-	--	--	--	--
109-66-0	Pentane, n-	--	--	--	--
75-44-5	Phosgene	--	--	--	--
123-38-6	Propionaldehyde	--	--	--	--
103-65-1	Propyl benzene	--	--	--	--
115-07-1	Propylene	--	--	--	--
75-56-9	Propylene Oxide	--	--	--	--
129-00-0	Pyrene	--	--	--	--
110-86-1	Pyridine	--	--	--	--
100-42-5	Styrene	--	--	--	--
630-20-6	Tetrachloroethane, 1,1,1,2-	--	--	--	--
79-34-5	Tetrachloroethane, 1,1,2,2-	--	--	--	--
127-18-4	Tetrachloroethylene	--	--	--	--
811-97-2	Tetrafluoroethane, 1,1,1,2-	--	--	--	--
109-99-9	Tetrahydrofuran	--	--	--	--
463-56-9	Thiocyanate	--	--	--	--
108-88-3	Toluene	--	--	--	--
76-13-1	Trichloro-1,2,2-trifluoroethane, 1,1,2-	--	--	--	--
87-61-6	Trichlorobenzene, 1,2,3-	--	--	--	--
120-82-1	Trichlorobenzene, 1,2,4-	--	--	--	--
71-55-6	Trichloroethane, 1,1,1-	--	--	--	--
79-00-5	Trichloroethane, 1,1,2-	--	--	--	--
79-01-6	Trichloroethylene	7.0E+03	2.82E+03	9.4E-04	3.2E+02
75-69-4	Trichlorofluoromethane	--	--	--	--
598-77-6	Trichloropropane, 1,1,2-	--	--	--	--
96-18-4	Trichloropropane, 1,2,3-	--	--	--	--
96-19-5	Trichloropropene, 1,2,3-	--	--	--	--
121-44-8	Triethylamine	--	--	--	--
526-73-8	Trimethylbenzene, 1,2,3-	--	--	--	--
95-63-6	Trimethylbenzene, 1,2,4-	--	--	--	--
108-67-8	Trimethylbenzene, 1,3,5-	--	--	--	--
108-05-4	Vinyl Acetate	--	--	--	--
593-60-2	Vinyl Bromide	--	--	--	--
75-01-4	Vinyl Chloride	--	--	--	--
108-38-3	Xylene, m-	--	--	--	--
95-47-6	Xylene, o-	--	--	--	--
106-42-3	Xylene, P-	--	--	--	--
1330-20-7	Xylenes	--	--	--	--

Inhalation Unit Risk	IUR Source*	Reference Concentration	RFC Source*	Mutagenic Indicator
		RfC (mg/m <sup>3</sup> )		i
		4.00E-02	H	
2.60E-07	CA	3.00E+00	I	
1.00E-08	I	6.00E-01	I	Mut
		1.00E-01	P	
3.40E-05	CA	3.00E-03	I	
4.00E-05	I	9.00E-03	I	
9.00E-06	P	2.00E-02	P	
2.70E-03	H	2.00E-02	I	
1.60E-03	I			
		2.00E-01	P	
		1.00E+00	P	
		3.00E-04	I	
		8.00E-03	I	
		1.00E+00	X	
		3.00E+00	CA	
3.70E-06	I	3.00E-02	I	
		1.00E+00	I	
7.40E-06	I			
5.80E-05	CA			
2.60E-07	I	4.00E-02	I	
		8.00E-01	I	
		2.00E+00	I	
		5.00E+00	I	
		3.00E+01	H	
		2.00E-03	P	
		5.00E+00	I	
1.60E-05	I	2.00E-04	X	
see note	I	2.00E-03	I	TCE
		7.00E-01	H	
		3.00E-04	I	Mut
		3.00E-04	P	
		7.00E-03	I	
		5.00E-03	P	
		7.00E-03	P	
		2.00E-01	I	
3.20E-05	H	3.00E-03	I	
4.40E-06	I	1.00E-01	I	VC
		1.00E-01	S	
		1.00E-01	S	
		1.00E-01	I	

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		Cgw	Cia	CR	HQ			RfC				
		(ug/L)	(ug/m³)					(ug/m³)-1				

x Notes:

(1) Inhalation Pathway Exposure Parameters (RME):		Units	Residential		Commercial		Selected (based on scenario)	
			Symbol	Value	Symbol	Value	Symbol	Value
	<b>Exposure Scenario</b>							
	Averaging time for carcinogens	(yrs)	ATc_R_GW	70	ATc_C_GW	70	ATc_GW	70
	Averaging time for non-carcinogens	(yrs)	ATnc_R_GW	30	ATnc_C_GW	25	ATnc_GW	25
	Exposure duration	(yrs)	ED_R_GW	30	ED_C_GW	25	ED_GW	25
	Exposure frequency	(days/yr)	EF_R_GW	350	EF_C_GW	250	EF_GW	250
	Exposure time	(hr/day)	ET_R_GW	24	ET_C_GW	8	ET_GW	8

(2) Generic Attenuation Factors:		Residential	Commercial		Selected (based on scenario)			
		Symbol	Value	Symbol	Value	Symbol	Value	
	<b>Source Medium of Vapors</b>							
	Groundwater	( - )	AFgw_R_GW	0.001	AFgw_C_GW	0.001	AFgw_GW	0.001
	Sub-Slab and Exterior Soil Gas	( - )	AFss_R_GW	0.1	AFss_C_GW	0.1	AFss_GW	0.1

(3) **Formulas**  
Cia, target = MIN( Cia,c; Cia,nc)  
Cia,c (ug/m³) = TCR x ATc x (365 days/yr) x (24 hrs/day) / (ED x EF x ET x IUR)  
Cia,nc (ug/m³) = THQ x ATnc x (365 days/yr) x (24 hrs/day) x RfC x (1000 ug/mg) / (ED x EF x ET)

(4) Special Case Chemicals		Residential	Commercial		Selected (based on scenario)		
		Symbol	Value	Symbol	Value	Symbol	Value
	Trichloroethylene	mIURTCE_R_GW	1.00E-06	mIURTCE_C_GW	0.00E+00	mIURTCE_GW	0.00E+00
		IURTCE_R_GW	3.10E-06	IURTCE_C_GW	4.10E-06	IURTCE_GW	4.10E-06

Mutagenic Chemicals      The exposure durations and age-dependent adjustment factors for mutagenic-mode-of-action are listed in the table below:

Note: This section applies to trichloroethylene and other mutagenic chemicals, but not to vinyl chloride.	Age Cohort	Exposure Duration	Age-dependent adjustment factor
	0 - 2 years	2	10
	2 - 6 years	4	3
	6 - 16 years	10	3
	16 - 30 years	14	1

Mutagenic-mode-of-action (MMOA) adjustment factor      25      This factor is used in the equations for mutagenic chemicals.

Vinyl Chloride      See the Navigation Guide equation for Cia,c for vinyl chloride.

### Notation:

I = IRIS: EPA Integrated Risk Information System (IRIS). Available online at: <http://www.epa.gov/iris/subst/index.html>  
P = PPRTV. EPA Provisional Peer Reviewed Toxicity Values (PPRTVs). Available online at: <http://hpptv.ornl.gov/pprtv.shtml>

A = Agency for Toxic Substances and Disease Registry (ATSDR) Minimum Risk Levels (MRLs). Available online at: <http://www.atsdr.cdc.gov/mrls/index.html>

CA = California Environmental Protection Agency/Office of Environmental Health Hazard Assessment assessments. Available online at: <http://www.oehha.ca.gov/risk/ChemicalDB/index.asp>

H = HEAST. EPA Superfund Health Effects Assessment Summary Tables (HEAST) database. Available online at: <http://epa-heast.ornl.gov/heast.shtml>

S = See RSL User Guide, Section 5

X = PPRTV Appendix

Mut = Chemical acts according to the mutagenic-mode-of-action, special exposure parameters apply (see footnote (4) above).

VC = Special exposure equation for vinyl chloride applies (see Navigation Guide for equation).

TCE = Special mutagenic and non-mutagenic IURs for trichloroethylene apply (see footnote (4) above).

Yellow highlighting indicates site-specific parameters that may be edited by the user.

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		Cgw	Cia	CR	HQ					
		(ug/L)	(ug/m <sup>3</sup> )							

x Blue highlighting indicates exposure factors that are based on Risk Assessment Guidance for Superfund (RAGS) or EPA vapor intrusion guidance, which generally should not be changed.

x Pink highlighting indicates VI carcinogenic risk greater than the target risk for carcinogens (TCR) or VI Hazard greater than or equal to the target hazard quotient for non-carcinogens (THQ).